

ence can alone show how far he has succeeded. We should doubt the efficacy of his instrument ourselves, and we certainly cannot indorse his belief that, "however scrupulous the draughtsman may be, however unbiassed he intends to be, errors may creep in, and therefore photo-micrography . . . comes in to insure complete veracity with a saving of labour."

Woodcuts are given of some few of the accessories enumerated. Chief among them is a very monotonous array of scalpels and probes, which form the frontispiece. Strange to say, the author makes not the least mention of most of those in his text, despite a reference in the index. It is clear, however, from the context, that they are to be regarded as aids to the study of insect anatomy: we have here a superfluity, for choice among the knives represented would be so embarrassing that, by the time the operator made up his mind, the subject itself would be far advanced towards decomposition. The introduction of curved scissors is no less to be deprecated. Apparatus and accessories have a fascination for most people, but the best work has always been done with the simplest tools. It must never be forgotten that it is the head at the one end, and not the mechanical aid at the other, which does the real work.

We would take exception to the introduction of the words "mountant," "semi-hard," and one or two others which might be named. The statement that the mites are "almost the smallest class of created beings" falls very unhappily from a pure microscopist, while the definition given of the Foraminifera needs modification.

We are pleased to note that the author has been mindful of the charms of the tow-net—perhaps the most important instrument in the future of marine zoology. If Mr. White's work be divested of its bugs' heads, and other similar objects which are the mainstay of those for whom he writes, there remains a solid substratum which far excels in merit that of many more pretentious works on the subject.

#### OUR BOOK SHELF.

*A Manual of the Geology of India.* Part IV. Mineralogy. By F. R. Mallet. Published by order of the Indian Government. (London: Trübner and Co., 1887.)

WHILE the third volume of this work possessed a certain interest for the statesman and the capitalist, including as it did descriptions of the minerals of economic value, the present one will only claim the attention of scientific readers. It may be a matter of surprise that nearly all that is certainly known about the minerals of India should be capable of compression into less than two hundred pages. But, as the author points out, excavations for mining or other purposes have not, as a rule, been superintended by men possessing the knowledge requisite to enable them to record facts of scientific importance; further, there is no demand for non-economic minerals, and consequently no mercenary incentive to collect specimens.

In looking over the book we are at once struck with the meagre character of much of the information given. Numbers of questions occur which we should like to see settled, but which are unanswerable in the present state of our knowledge, or rather ignorance, of Indian mineralogy. But our author is certainly not to blame for this. He has made the most of the scanty materials at his command, and the result is a valuable contribution to mineralogical science, which will serve as a basis for

a future work on the subject worthy of our Indian Empire. The classification adopted is that of Dana, as given in his "System of Mineralogy."

In the collection of materials for the book which we hope will grow out of this, English residents and educated natives might do science much service. The study of mineralogy was extensively pursued in England until displaced by the more attractive subject of stratigraphy, but as India presents such a vast field there is no reason why the subject should not become popular again. Workers in this department will find Mr. Mallet's book of the greatest service.

*Through the Yang-tse Gorges.* By A. J. Little, F.R.G.S. (London: Sampson Low, 1888.)

MR. LITTLE recently undertook a two months' journey from Shanghai, the metropolis of the Chinese coast, to Chung-King, the commercial metropolis of Western China. The present volume consists of the journal kept during his travels, and an admirable journal it is, full of the results of careful and minute observation, and written in a fresh, lively, and entertaining style. Few travellers, with the exception of "the ubiquitous missionary," have ascended to the highest navigable point of the Yang-tse, the only road of intercommunication between the eastern and western districts of the Chinese Empire. Most readers, therefore, will find in this book much that is new to them about the Chinese people and their country. There are many vivid descriptions of the varied scenery through which Mr. Little passed, and his notes on industries, social customs, and popular religious ideas are invariably interesting and suggestive. Upon the whole, he has no very exalted opinion of the intellectual and moral qualities of the Chinese, and he is not disposed to believe that the empire, under the influence of Western ideas, is about to enter upon a new and momentous stage of political and social development. Everywhere he found the bureaucracy intensely conservative, and bitterly prejudiced against foreigners. They are willing enough to adopt superior mechanical appliances, so far as implements of war are concerned; but in all other matters they prefer to move along the old lines, which, having been good enough for their forefathers, must, they think, be good enough for themselves.

*Home Experiments in Science.* By T.O'Connor Sloane, Ph.D. (London: Sampson Low, Marston, Searle, and Rivington, 1888.)

THE author of this work has produced a very readable and useful book for those who wish to employ their leisure hours in gaining knowledge and information about the elementary parts of the various branches of science. The volume consists of a collection of experiments that can be easily performed with home-made apparatus; good detailed instruction as to the necessary mechanical operations is given, together with ninety-seven woodcuts of the experiments and the apparatus employed. The branches of science included in these experiments are mechanics, general and molecular physics; the chapter on soap-bubbles contains some very interesting experiments about them; and the concluding chapter consists of hints to those who are about to begin scientific lecturing.

#### LETTERS TO THE EDITOR.

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. No notice is taken of anonymous communications.]

#### Prof. Rosenbusch's Work on Petrology.

OF the great value of Prof. Rosenbusch's work on petrology, so excellently reviewed by Dr. Hatch, to which your corre-

spondent "A. B." draws attention, there can be no doubt, so far as it is regarded as a storehouse of information; but whether the system of classification proposed therein will not tend to retard rather than to further progress is a question on which I am at present more than doubtful. The two points to which Dr. Hatch and your correspondent draw attention as inherent weaknesses—viz. the "dyke rocks," and the subdivision of the "effusive rocks" into palæo-volcanic and neo-volcanic—appear to me such serious defects, that to praise a system which largely rests on them is like complimenting a viaduct by saying that it is an excellent viaduct but two of its piers unfortunately have a bad foundation.

But dismissing this as a question too large for discussion in your columns, I will confine my remarks to some defects in detail, rather serious as they appear to me, which are exhibited by the classification as tabulated by your correspondent.

(1) A mere "linear" classification fails, I believe, to represent satisfactorily the relation of the igneous rocks, because it separates too widely rocks very closely related—such, for instance, as the *Dacites* and *Rhyolites* (*Liparites*), and their corresponding holocrystalline representatives. Hence I believe that the branching system such as I indicated in my Presidential Address to the Geological Society in 1885 is more logical and more in accordance with the facts of Nature.

(2) In regard to the above example, I fail to understand why *Dacites* should be included with *Andesites* and *Liparites* separated from *Trachytes*, or, if we speak of their holocrystalline representatives, why we should separate *Granite* from *Syenite*, while we include *Tonalite* with *Diorite*. It is true that *Granites* are common and *Tonalites* are rare, and possibly the latter always contain some hornblende; but until it is shown that a quartz-plagioclase-biotite rock does not exist, or that the substitution of hornblende for biotite is of primary importance, there does not seem any valid reason for suppressing the group.

(3) As the term *Diabase* has long had a recognized meaning, I fail to see any good reason for substituting it for *Dolerite*, to which, as generally understood, it stands in much the same relation as do many *Serpentines* to *Peridotites*. Neither can I admit the propriety of separating *Gabbro* from it.

(4) The wide separation of the *Leucite* and *Nepheline* rocks from the *Basalts* seems also to me to be of doubtful advantage.

(5) If the term *Peridotite* be used in the sense in which it has generally been employed (e.g. by Dr. Wadsworth in his excellent "Lithological Studies")—namely, to denote a rock in which silicates of magnesia and iron abound, with some also containing lime but with little alumina—it is surely not possible to regard *Limburgite* as its "effusive" equivalent. That rock seems to me to be more properly associated with the *Picrites*, not as defined by Dr. Wadsworth (i.e. olivine-augite rocks), but as equivalent to the *Palæopicrites* of some authors—viz. pyroxenic rocks, containing a fair amount of olivine, and some feldspar, which last, however, has a very variable proportion. The true position of these rocks appears to me to be as a connecting-link between the *Peridotites* and the *Dolerites*.

There are other points in the work to which I should like to call attention, but I am writing away from books, and should have refrained for a season had not "A. B.'s" letter seemed to me to call for a word of friendly protest. No one can be more deeply sensible than I am of the value in many respects of Prof. Rosenbusch's work, but until his classification rests on a firmer foundation it will not, I fear, be really helpful to students in leading them to clearer ideas on a complicated and difficult subject.

T. G. BONNEY.

### The Delicacy of the Sense of Taste.

AT the Philadelphia meeting of the American Association, in 1884, we presented a paper upon the general subject of the "Sensitiveness of the Special Senses." We have since continued our investigations,<sup>1</sup> and have the honour to present at this time the results of some experiments upon the sense of taste.

The object of the experiments herein described was to find out what substances, or classes of substances, are most readily detected by the sense of taste, and the relative delicacy of this

sense towards these substances. For the production of familiar typical effects upon the organs of sense the following substances were selected:—

|                |   |   |   |                     |
|----------------|---|---|---|---------------------|
| I. (bitter)    | . | . | . | Quinine.            |
| II. (sweet)    | . | . | . | Cane sugar.         |
| III. (acid)    | . | . | . | Sulphuric acid.     |
| IV. (alkaline) | . | . | . | Sodium bicarbonate. |
| V. (saline)    | . | . | . | Common salt.        |

The attempt was made to include other substances in this list, but it was difficult to find any, not embraced in the five classes above mentioned, which would not betray their presence either by colour or odour. Indeed it is surprising, to one who has not given the subject attention, to what an extent we are accustomed to depend upon the aid of the sense of smell in the classification of tastes. The fact has been noticed by several authors that, if the nostrils are closed, the range of our taste becomes very much limited.

Our method of testing the delicacy of the sense of taste was to make solutions, of known strength, of the different substances; then, by successive dilutions, to make from these several series of weaker solutions; each one being of one-half the strength of that preceding it. All the bottles containing these substances, and several bottles of water, being placed side by side without regard to order, the person to be tested was requested to taste of each solution and place it in its proper class. In each series the lowest solution was so very dilute that it was deemed impossible to distinguish it from water. Unknown solutions were to be classed with water. As the tasters were found to be liable to mistake occasionally even the stronger solutions, an opportunity was given, at the close of the test, to correct such accidental errors. In carrying out these tests we found that the most trustworthy results were to be obtained by instructing each operator to pick out the stronger solutions, temporarily classifying with water all which were not immediately recognized; and then to go over the latter solutions a second time, properly classifying such as could further be detected.

These tests were made by 128 persons, between the ages of twelve and fifty—eighty-two men and forty-six women. The average results are given in the following table:—

Table of Averages.

|                                   |         |                 |  |  |
|-----------------------------------|---------|-----------------|--|--|
| I. Quinine.                       |         |                 |  |  |
| Male observers detected 1 part in | 390,000 | parts of water. |  |  |
| Female " " 1 " "                  | 456,000 | " "             |  |  |
| II. Cane sugar.                   |         |                 |  |  |
| Male observers detected 1 part in | 199     | parts of water. |  |  |
| Female " " 1 " "                  | 204     | " "             |  |  |
| III. Sulphuric acid.              |         |                 |  |  |
| Male observers detected 1 part in | 2080    | parts of water. |  |  |
| Female " " 1 " "                  | 3280    | " "             |  |  |
| IV. Bicarbonate of soda.          |         |                 |  |  |
| Male observers detected 1 part in | 98      | parts of water. |  |  |
| Female " " 1 " "                  | 126     | " "             |  |  |
| V. Common salt.                   |         |                 |  |  |
| Male observers detected 1 part in | 2240    | parts of water. |  |  |
| Female " " 1 " "                  | 1980    | " "             |  |  |

This table indicates only the average delicacy of taste for each substance included in our experiments. The tests brought to light many astonishing individual peculiarities. For instance, there were persons who could detect with certainty 1 part of quinine in 5,120,000, while others failed to notice 1 part in 160,000. How far this difference is due to education it is not possible to say. Among the tasters were quite a large number who had been accustomed for several years to the handling and recognition of drugs and chemicals. Their record was considerably above the general average, but they were, on the other hand, surpassed by a few individuals who had had no previous training.

The results of our experiments may be briefly summed up as follows:—

1. The sense of taste is much more delicate for bitter substances than for the others included in our list. (The relative delicacy for quinine and sugar is very nearly 2000:1.)

2. Taken in the order of their effect upon the organs of taste,

<sup>1</sup> See the following papers:—"On the Relative Bitterness of different Bitter Substances" (Proceedings of the Kansas Academy of Sciences, 1885); "On the Relative Sweetness of different Sugars" (Reports of the Kansas Board of Agriculture, 1885); "On the Sensitiveness of the Eye for Colours of a Low Degree of Saturation" (*American Journal of Science*, III. vol. xxx. p. 27); "The Sense of Smell" (*NATURE*, vol. xxxv. p. 74).